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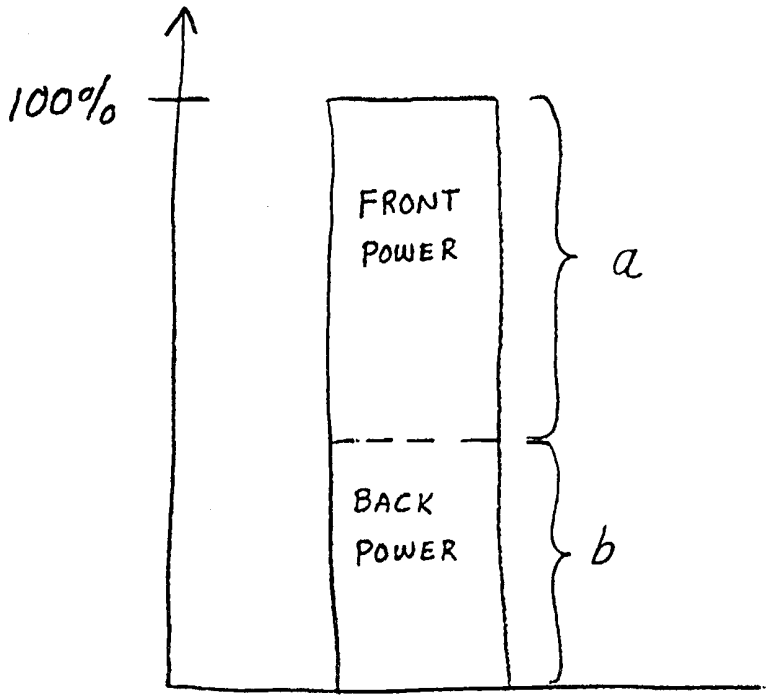
(54) Title: MULTIFOCAL LENS DESIGNS WITH FRONT SURFACE AND BACK SURFACE OPTICAL POWERS

(57) Abstract

The present invention provides a contact or intraocular lens in which the optical power is divided between the front surface of the lens and the back surface of the lens. The division between front surface power and back surface power may vary across a wide spectrum, ranging from nearly all front surface power to nearly all back surface power, and all point in between, depending on the particular lens requirements. The lens design according to the present invention is such that the front add power "a" and the back add power "b" cumulatively combine, "a" + "b", to provide 100% of the required optical power. To achieve this division of front power and back power, substantially the same concentric pattern is formed on both the front surface and back surface of the lens. The percent of near add power formed on the front surface versus that formed on the back surface is allowed to vary between almost 0% and almost 100%, with almost 0% being substantially all back power and almost 100% being substantially all front power.



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MULTIFOCAL LENS DESIGNS WITH FRONT SURFACE AND BACK SURFACE OPTICAL POWERS

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates generally to multifocal lens designs. More particularly, the present invention pertains to multifocal lens designs with optical powers provided on both the front surface and back surface of the lens.

DISCUSSION OF THE PRIOR ART

The present invention pertains to ophthalmic lenses, and in particular to contact lenses such as soft hydrogel contact lenses, and intraocular lenses, having more than one optical power or focal length.

It is well known that as an individual ages, the eye is less able to accommodate, i.e., bend the natural lens in the eye in order to focus on objects that are relatively near to the observer. This condition is referred to as presbyopia, and presbyopes have in the past relied upon spectacles or other lenses having a number of different regions with different optical powers to which the wearer can shift his vision in order to find the appropriate optical power for the object or objects upon which the observer wishes to focus.

With spectacles, the process involves shifting one's field of vision from typically an upper lens portion far power to a lower lens portion near power. With soft or hydrogel contact lenses, however, this approach has been less than satisfactory. The contact lens, working in conjunction with the natural lens, forms an image on the retina of the eye by focusing light incident on each part of the cornea from different field angles onto each part of the retina in order to form an image. This is demonstrated by the fact that as the pupil contracts in response to brighter light, the image on the retina does not shrink, but rather, light comes through a smaller area of the lens to form the entire image.

Similarly, for a person that has had the natural lens of the eye removed because of a cataract condition and an intraocular lens inserted as a replacement, the ability to adjust the lens (accommodate) the distance of the object being viewed is totally absent. In this case, the lens provided is usually set at a single infinite distance focal power, and spectacles are worn to provide the additional positive optical power

needed for in-focus closer vision. For such a patient, a functional multifocal lens would be particular useful.

It is also known in the art that under certain circumstances the brain can discriminate between separate competing images by accepting an in-focus image and rejecting an out-of-focus image.

U.S. Pat. No. 5,448,312 entitled PUPIL TUNED MULTIFOCAL OPHTHALMIC LENS, discloses a multifocal concentric ophthalmic lens for presbyopic patients constructed with three general annular lens portions in a multifocal design. A central circular portion of the lens has only the patient's distance corrective power, and is surrounded by a first inner annular portion, which can consist of multiple annular rings having an inner radial portion which enhances the patient's near focal power encircled by radial portions of substantially equal cumulative amounts of distance and near optical power focal correction for the patient. This is surrounded by a second outer annular portion, which can also consist of one or more annular rings having additional distance focal power near the periphery of the optical surface area of the ophthalmic lens. Each annular ring has either a near or distance optical power and works in combination with other lens portions to yield the desired focal ratio in that portion of the lens.

U.S. Patent No. 5,485,228, entitled MULTIFOCAL OPHTHALMIC LENS PAIR, discloses a pair of ophthalmic lenses both containing at least two optical powers, one is biased for near vision and one is biased for distance vision. Both lenses, however, contain the distance power in the center portion of the lens. In one embodiment, the remainder of the lens includes annular portions, each made of one or more optical zones to provide the desired combined, cumulative ratio of near and distance focal length areas at each pupil diameter. In this way, the center portion of the vision contains a single optical power which results in improved visual acuity. This distance portion in the center is particularly well suited to the real world situation of requiring distance vision under high illumination situations.

The patents referred to above are hereby incorporated by reference in their entirety.

In prior art lens designs, it is known to form the optical power on either the front surface or back surface of the lens. On the other hand, a front surface design can cause a ghost image to form, i.e., the distance image and the near image are both sharp and are both presented at the same time to the eye.

SUMMARY OF THE INVENTION

It is an object, therefore, of the present invention to provide an ophthalmic lens for a presbyope that yields improved visual acuity in general without visual artifacts.

The present invention provides a contact or intraocular lens in which the optical add power is divided between the front surface of the lens and the back surface of the lens. The division between front surface power and back surface power may vary across a wide spectrum, ranging from nearly all front surface power to nearly all back surface power, and all points in between, depending on the particular lens requirements. The lens may be of the type which matches the distribution of near, intermediate and distance focal vision corrections to the type of human activity typically undertaken in various illumination conditions. The lens may also be of the type which matches the particular dimensions of a contact lens to suit the size of the pupil of the wearer as a function of illumination intensity. The ophthalmic lens may be of the type designed to provide predominantly distance correction under high illumination, nearly evenly divided distance and near corrections under moderate illumination, and provide intermediate, vision correction under low to moderate illumination levels. The lens may also be of the type designed to match the wearer's pupil size as a function of illumination level, and in preferred embodiments by also applying pupil size parameters as a function of the age of the wearer.

In accordance with the teachings herein, the present invention provides a multifocus, concentric annular ring lens wherein on both the front and rear surfaces of the lens, there is defined a central area comprising a circular disc having a spherical surface corresponding to a basic prescription spherical distance optical power. A plurality of annular rings surround the central area and have alternating spherical near optical powers and spherical distance optical powers, and optionally, at least one intermediate optical power annular ring. The intermediate optical power annular ring may be located in the outer region of the lens optic zone, and its optical power is intermediate to the distance and near optical powers, to provide visual acuity at intermediate distances.

In greater detail, the intermediate optical power annular ring or rings can be placed in the outer radial portion of the optic zone, where it can be an annular ring in that portion, or it may consist of the entire outer radial portion, or it can be placed in the middle radial portion, where it is preferably placed in the outer edge thereof, or it may be placed anywhere in that portion. The lens can be a contact lens to be worn on the cornea of the eye, such as a soft hydrogel contact lens, or an be an intraocular lens.

The central area and the plurality of annular rings are essentially formed on both the front surface and the back surface of a contact lens, such that the cumulative front surface power and back surface power corresponds to the desired prescriptive power of the lens. Moreover, the widths of the individual annular rings can be different to generate a power profile which varies to generate different ratios of distance optical power to intermediate and near optical power.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and advantages of the present invention for multifocal lens designs with both front surface power and back surface power may be more readily understood by one skilled in the art with reference being had to the following detailed description of several preferred embodiments thereof, taken in conjunction with the accompanying drawings wherein like elements are designed by identical reference numerals throughout the several views, and in which:

FIG. 1 shows the front optical zone of an ophthalmic lens constructed according to the principles of the present invention;

FIG. 2 shows the front optical zone of an ophthalmic lens constructed according to the principles of the present invention;

FIG. 3 is a bar graph/histogram illustrating the cumulative combination of front surface power and back surface power according to the present invention;

FIG. 4 shows the front optical zone of an ophthalmic lens constructed according to the principles of the present invention; and

FIG. 5 shows the front optical zone of a pair of ophthalmic lenses constructed according to the principles of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings in detail, FIG. 1 illustrates one type of lens 10 designed pursuant to the teachings of the present invention wherein a central area 12 is a circular disc containing the basic prescribed Rx spherical distance power, and is surrounded by a plurality of alternating spherical near power and spherical distance power annular rings 14, 16, 18 and 20. In the first embodiment of FIG. 1, an intermediate optical power annular ring 22, having an optical power intermediate to the distance and near optical powers, is added as the second outermost annular ring. The intermediate optical power annular ring 22 is encompassed by an outermost distance optical power annular ring 24.

A preferred intermediate optical power is 50% of the difference between the distance and near optical powers, but could be chosen to be any optical power between the distance and near optical powers. A preferred position for the intermediate optical power annular ring is in the outer region of the lens optic zone 26, preferably the second outermost annular ring 22 from the outer edge of the lens optic zone 26. The totality of the area encompassed by the outer circumference of the outermost ring 24 defines the optic zone 26 of the lens 10, which includes the areas of 12, 14, 16, 18, 20, 22 and 24. The optic zone 26 is surrounded by a peripheral zone 28, which is a nonoptical area of the lens, which is beveled at 30 to the outer circumference 32 of the lens.

In one example, the center disc 12 has a diameter of 2.15 mm, annular ring 14 has a diameter of 3.30 mm, annular ring 16 has a diameter of 3.60 mm, annular ring 18 has a diameter of 4.30 mm, annular ring 20 has a diameter of 4.80 mm, annular ring 22 has a diameter of 5.35 mm, annular ring 24 has a diameter of 8.00 mm, the lenticular annular area 28 has a diameter of 13.0 mm to the start of beveled area 28 has a diameter of 13.0 mm to the start of beveled area 30, and the outer circumference of the lens has a diameter of 14.0 mm. Of course, other dimensions may be used depending on the particular requirements of the desired lens.

FIG. 2 is a plan view of a second embodiment of a multifocal lens design having an intermediate optical power wherein the intermediate optical power annular ring 44 is the outermost annular ring 44 in the optical zone 46 of the lens. Similar to the first embodiment, a central area 33 is a circular disc containing the basic prescribed spherical distance power, and is surrounded by a plurality of alternating spherical near power and spherical distance power annular rings 34, 36, 38, 40 and 42. The intermediate optical power annular ring is the outermost annular ring 44 within the lens optic zone 46. The combined areas of the central spherical disk 33 and the surrounding annular rings 34 through 44 comprise the active optical area 46 of the lens, which is surrounded by a peripheral (nonoptical) area 48 which is beveled at its outer circumference at 50 to an outer circumferential edge 52.

By varying the widths of the individual annular rings, a power profile can be created which generates different ratios of distance optical power to near and intermediate optical powers with increasing distance from the center of the lens.

A person's pupil size is a function which is dependent upon light intensity, and is an important parameter in the design of ophthalmic lenses, particularly contact lenses and intraocular lenses.

Reliable data was obtained from people in four different age groups. Those less than 20 years of age, those between 20 and 40 years of age, those between 40 and 60 years of age, and those over 60 years of age. These pupil measurements were made on test subjects at three different luminance levels, 250, 50 and 2.5 candellas per square meter (cd/m^2).

The 250 cd/m^2 level corresponds to extremely bright illumination typically outdoors in bright light. The 50 cd/m^2 is a mixed level which is found in both indoors and outdoors. Finally, the 2.5 cd/m^2 level is most typically found outdoors at night, usually in an uneven illumination situation such as night driving.

The results of these studies are given in the following Table I, which includes in addition to the average pupil diameter at three different illumination levels, the standard deviation in the diameter and the range associated therewith.

TABLE I

Illumination (candellas/m^2)	Average Pupil Diameter (mm)	Standard Deviation (1δ)
	HORIZONTAL PUPIL SIZE	
	LESS THAN 20 YEARS OF AGE	
2.5	6.5962	0.9450
50	4.3499	0.5504
250	3.4414	0.3159
	20 to 40 YEARS OF AGE	
2.5	6.4486	0.8259
50	4.4843	0.6342
250	3.5040	0.4217
	40 to 60 YEARS OF AGE	
2.5	5.4481	0.9787
50	3.6512	0.5692
250	3.0368	0.4304
	GREATER THAN 60 YEARS OF AGE	
2.5	4.7724	0.6675
50	3.4501	0.5106
250	2.8260	0.3435

Taken in combination with this data are the determinations that have been made regarding real world human activity typically encountered under different illumination levels. At very high illumination levels, such as that represented by 250 cd/m^2, human activity is typically taking place outdoors in bright sunlight and requires distant vision tasks.

At a 50 cd/m^2 illumination level, activity usually occurs both indoors and out, and typical human activity is represented by both near and far visual tasks.

Finally, at low illumination levels represented by the 2.5 cd/m^2, the activity that takes place is typically outdoors at night and usually involves distant vision tasks, such as driving an automobile.

The corrective powers as a function of the distance from the center of the lens must be a function of the patient's specifically measured pupil diameter at varying

illumination levels, or it can be readily determined from the above information based upon the age of the patient.

Moreover, ocular in vivo image quality measurement devices can be used to optimize the ocular image quality in the concentric annular ring designs to produce even more improved designs. This is accomplished by using an in vivo image quality measurement device, such as an aberroscope or MTF point spread measuring device, to measure and decrease the sum of the aberrations of the combination of the lens and the eye system.

Referring now to FIG. 3, therein is illustrated a bar graph/histogram showing the division of front power and back power according to the present invention. The front add power "a" is the amount of the total optical power which is formed on the front surface of the lens, while the back add power "b" is the amount of the total optical power which is formed on the back surface of the lens. As shown in FIG. 3, the front power and the back power cumulatively combine, "a" + "b", to provide 100% of the required optical add power. To achieve this division of front power and back power, substantially the same concentric pattern is formed on both the front surface and back surface of the lens. The percent of near add power formed on the front surface versus that formed on the back surface is allowed to vary between almost 0 and almost 100%, with almost 0% being substantially all back power and almost 100% being substantially all front power. FIGS. 1 and 2 illustrate the optical surface of the front surface, it being understood that in accordance with the present invention, the optical surface of the back surface is substantially similar to that of the front surface, the only difference being in the amount of power provided by each of the surfaces.

FIG. 4 illustrates the optical surface of an alternative ophthalmic lens constructed according to the present invention. As shown in FIG. 4, the center and second, fourth and sixth annular portions "D" of the optical surface are distance vision. Similarly, the first, third and fifth annular portions "N" are near vision. The lens design of FIG. 4 does not include an intermediate power portion. Again, similar to the lens design described above with reference to FIGS. 1-3, the lens design of FIG. 4 is such that the front add power "a" and the back add power "b" cumulatively combine, "a" + "b", to provide 100% of the required optical power. To achieve this division of front power and back power, substantially the same concentric pattern is formed on both the front surface and back surface of the lens. The percent of near add power formed on the front surface versus that formed on the back surface is allowed to vary between almost 0 and almost 100%, with almost 0% being substantially all back power and almost 100% being substantially all front power.

Referring now to FIG. 5, therein is illustrated the optical zone of the front surface of a pair of ophthalmic lenses constructed according to U.S. Patent No. 5,485,228, which are modified to include the teachings of the present invention. Specifically, the front add power "a" and the back add power "b" cumulatively combine, "a" + "b", to provide 100% of the required optical power. To achieve this division of front power and back power, substantially the same concentric pattern is formed on both the front surface and back surface of the lens. The percent of near add power formed on the front surface versus that formed on the back surface is allowed to vary between almost 0 and almost 100%, with almost 0% being substantially all back power and almost 100% being substantially all front power

Obviously, many different embodiments of the present invention are possible, with alterations of the number of annular rings, the widths and arrangement of the annular rings, and the optical powers assigned to each of the annular rings, along with the division of optical power between the front surface and back surface of the lens.

While several embodiments and variations of the present invention for multifocal lens designs with both front power and back power are described in detail herein, it should be apparent that the disclosure and teachings of the present invention will suggest many alternative designs to those skilled in the art, such as distance center concentric, near center concentric, aspheric, progressive and radial symmetric lenses.

WHAT IS CLAIMED IS:

1. A multifocus ophthalmic lens containing a predefined optical add power, said lens comprising:

a front surface and a back surface, said front surface including a predefined pattern in a first amount which provides a front portion of said predefined optical add power, said back surface including said predefined pattern in a second amount which provides a back portion of said predefined optical add power, wherein the sum of said front portion and said back portion is substantially equal to said predefined optical add power.

2. The lens of claim 1, wherein said front portion is greater than said back portion.

3. The lens of claim 1, wherein said front portion is less than said back portion.

4. The lens of claim 1, wherein said predefined pattern includes a central area corresponding to a first optical power, and a plurality of annular rings surrounding the central area, each of said plurality of rings having one of said first optical power and a second optical power.

5. The lens of claim 4, wherein said first optical power corresponds to a distance optical power and said second optical power corresponds to a near optical power.

6. The lens of claim 4, further comprising an annular ring having an intermediate power.

7. The lens of claim 1, wherein said predefined pattern includes a central area corresponding to a second optical power, and a plurality of annular rings surrounding the central area, each of said plurality of rings having one of said second optical power and a first optical power.

8. The lens of claim 7, wherein said second optical power corresponds to a near optical power and said first optical power corresponds to a distance optical power.

9. The lens of claim 7, further comprising an intermediate power ring.

10. The lens of claim 1, wherein the lens comprises a contact lens to be worn on a cornea of the eye.

11. The lens of claim 1, wherein the contact lens comprises a soft hydrogel contact lens.

12. The lens of claim 1, wherein the lens comprises an intraocular lens.

13. The lens of claim 1, wherein said lens is one of a distance center concentric, near center concentric, aspheric, progressive and radial symmetric lens.

FIG. 1

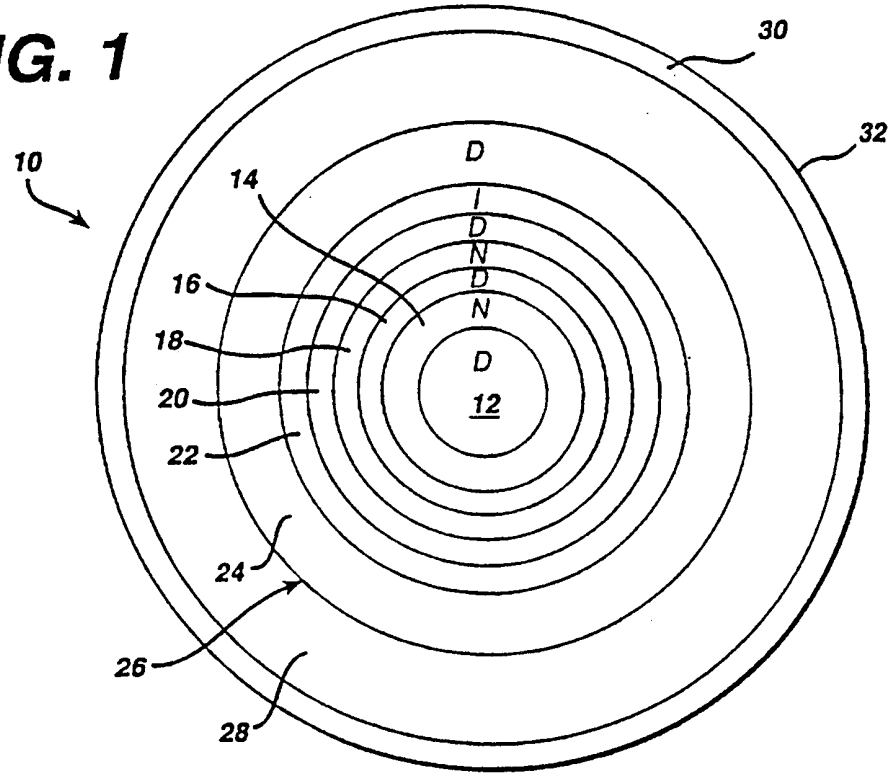
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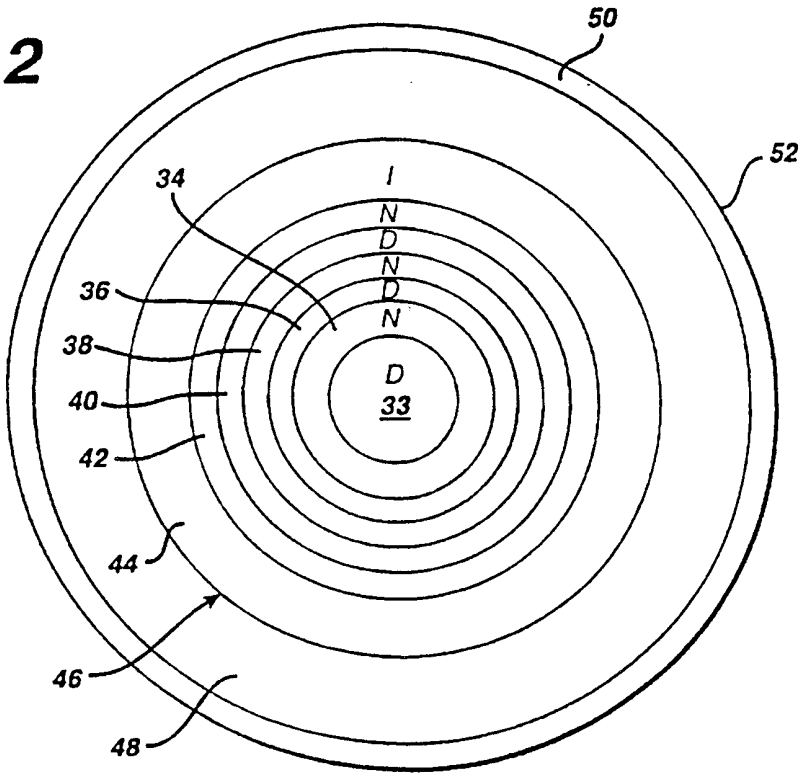
FIG. 2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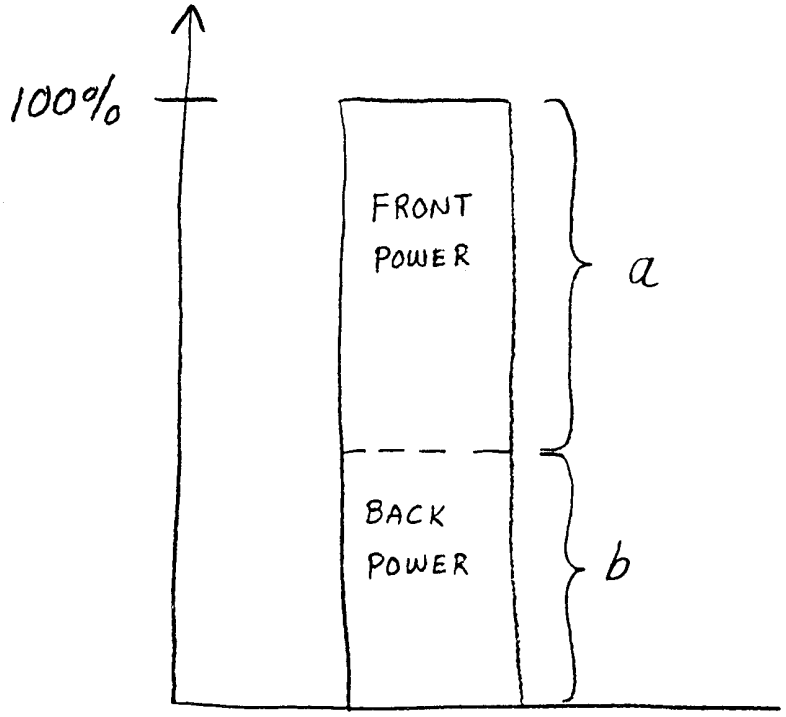


FIG. 3

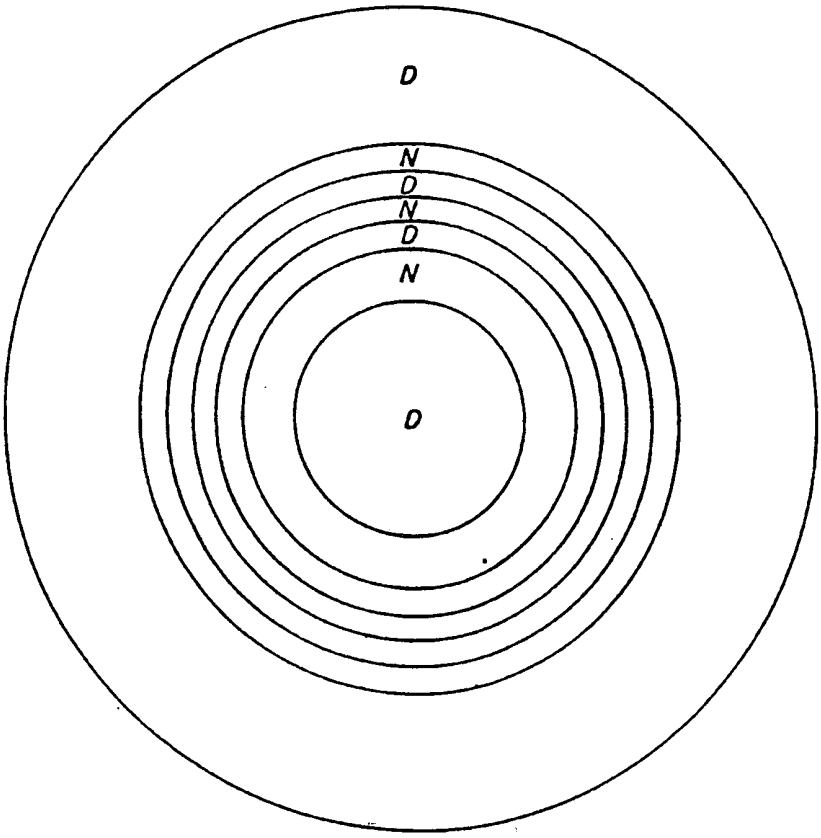
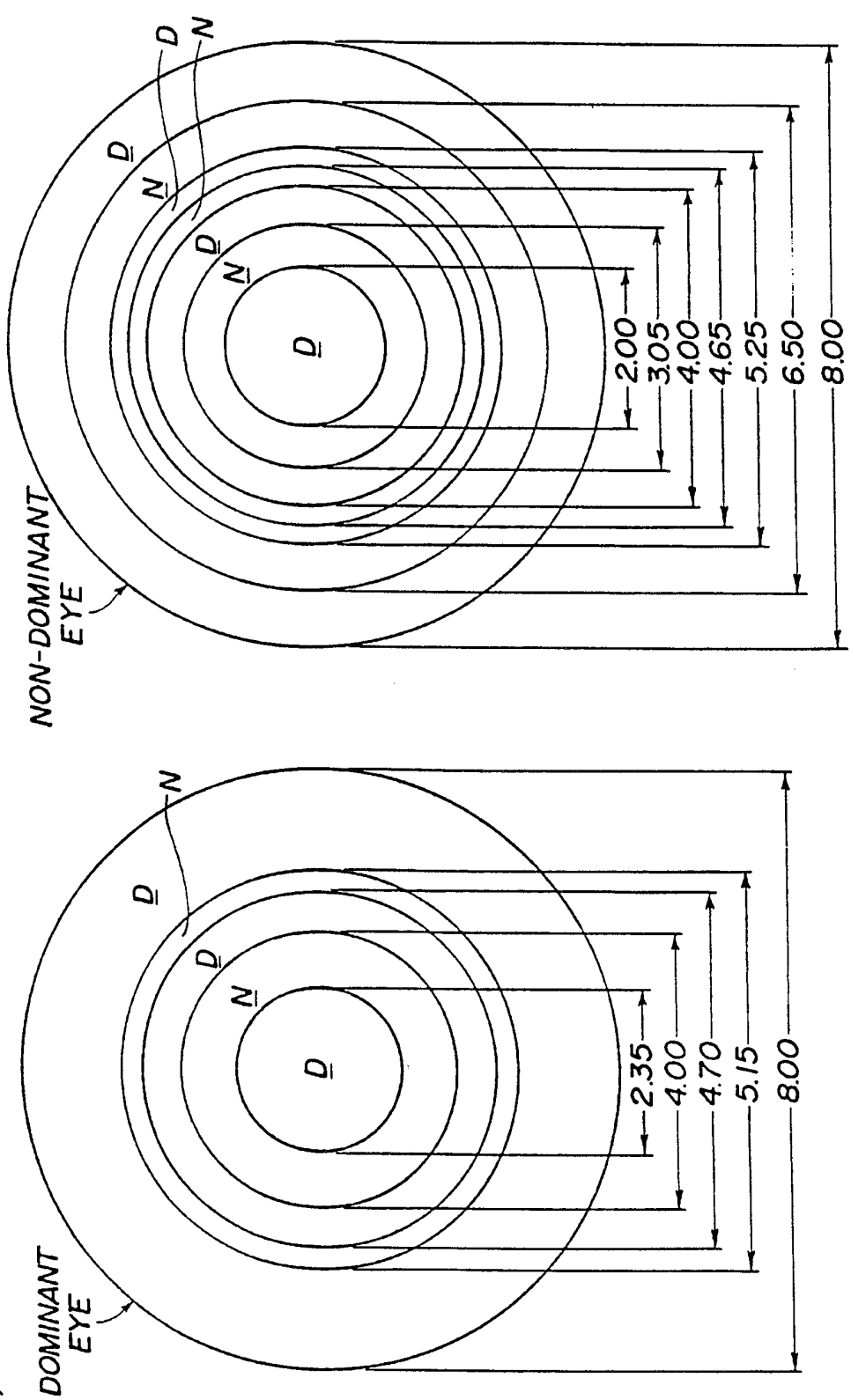


FIG 4

FIG-5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INTERNATIONAL SEARCH REPORT

Inter. ›nal Application No
PCT/US 00/08754

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02C7/04

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Minimum documentation searched (classification system followed by classification symbols)
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EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 835 187 A (MARTIN RICHARD R) 10 November 1998 (1998-11-10) column 1, line 63 -column 263	1
A	EP 0 756 189 A (JOHNSON & JOHNSON VISION PROD) 29 January 1997 (1997-01-29) abstract; claims	1,4-6, 10-12
A	WO 96 08745 A (PERMEABLE TECH INC) 21 March 1996 (1996-03-21) claims	1,4-6, 10,11,13
A	EP 0 742 461 A (JOHNSON & JOHNSON VISION PROD) 13 November 1996 (1996-11-13) abstract	1,4,5, 10-12

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Date of the actual completion of the international search	Date of mailing of the international search report
21 July 2000	27/07/2000

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INTERNATIONAL SEARCH REPORT

Inter. ›nal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 448 312 A (GUILLON MICHEL ET AL) 5 September 1995 (1995-09-05) cited in the application claims	1,4,5, 10,12
A	US 5 485 228 A (ROFFMAN JEFFREY H ET AL) 16 January 1996 (1996-01-16) cited in the application claims	1,4,5, 10,12

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INTERNATIONAL SEARCH REPORT

information on patent family members

Inter nal Application No
PCT/US 00/08754

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5835187 A	10-11-1998	NONE	
EP 0756189 A	29-01-1997	US 5682223 A	28-10-1997
		AU 694341 B	16-07-1998
		AU 5206996 A	14-11-1996
		BR 9602152 A	30-12-1997
		CA 2175652 A	05-11-1996
		CN 1171557 A	28-01-1998
		HU 9601157 A	28-01-1997
		JP 9047463 A	18-02-1997
		NO 961801 A	05-11-1996
		SG 47134 A	20-03-1998
WO 9608745 A	21-03-1996	AU 7955794 A	29-03-1996
EP 0742461 A	13-11-1996	AU 707422 B	08-07-1999
		AU 5206796 A	14-11-1996
		BR 9602168 A	13-01-1998
		CA 2175653 A	05-11-1996
		CN 1164652 A	12-11-1997
		JP 9021905 A	21-01-1997
		NO 961803 A	05-11-1996
		NZ 286484 A	19-12-1997
		SG 46732 A	20-02-1998
		US 5796462 A	18-08-1998
US 5448312 A	05-09-1995	AT 168476 T	15-08-1998
		AU 676855 B	27-03-1997
		AU 5183793 A	23-06-1994
		BR 9304981 A	21-06-1994
		CA 2110844 A	10-06-1994
		CN 1089826 A	27-07-1994
		CZ 9302680 A	14-02-1996
		DE 69319701 D	20-08-1998
		DE 69319701 T	04-02-1999
		EP 0601846 A	15-06-1994
		ES 2118911 T	01-10-1998
		FI 935486 A	10-06-1994
		GR 93100462 A,B	31-08-1994
		HU 65866 A	28-07-1994
		IL 107604 A	15-04-1997
		JP 7005399 A	10-01-1995
		MX 9307764 A	29-07-1994
		NO 934482 A	10-06-1994
		NZ 250358 A	26-03-1996
		ZA 9309212 A	08-06-1995
US 5485228 A	16-01-1996	US 5198844 A	30-03-1993
		AT 170990 T	15-09-1998
		AU 674709 B	09-01-1997
		AU 5226693 A	23-06-1994
		BR 9304976 A	28-06-1994
		CA 2110847 A	10-06-1994
		CN 1089825 A	27-07-1994
		CZ 9302679 A	15-12-1994
		DE 69320923 D	15-10-1998
		DE 69320923 T	04-03-1999
		EP 0601845 A	15-06-1994

INTERNATIONAL SEARCH REPORT

...formation on patent family members

Inter nal Application No
PCT/US 00/08754

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5485228 A		FI 935487 A	10-06-1994
		GR 93100492 A,B	31-08-1994
		HU 3826 A	28-11-1997
		JP 7005400 A	10-01-1995
		NO 934481 A	10-06-1994
		NZ 250359 A	26-07-1996
		ZA 9309207 A	08-06-1995
		AT 164949 T	15-04-1998
		AU 663744 B	19-10-1995
		AU 3103993 A	29-07-1993
		CA 2088219 A	29-07-1993
		CZ 282423 B	16-07-1997
		DE 69317804 D	14-05-1998
		DE 69317804 T	20-08-1998
		DK 553959 T	11-05-1998
		EP 0553959 A	04-08-1993
		IL 104249 A	06-12-1998
		JP 6003629 A	14-01-1994
		SG 68540 A	16-11-1999
		SK 377492 A	10-05-1995
		US 5512220 A	30-04-1996
		US 5349396 A	20-09-1994
		AU 650550 B	23-06-1994
		AU 1941192 A	14-01-1993
		BR 9202524 A	16-03-1993
		CA 2073536 A	11-01-1993
		CN 1070743 A,B	07-04-1993
		EP 0522852 A	13-01-1993
		EP 0764870 A	26-03-1997
		FI 923173 A	11-01-1993
		GR 92100213 A,B	24-05-1993
		HU 63007 A	28-06-1993
		IL 102029 A	31-01-1996
		JP 5188332 A	30-07-1993
		MX 9204025 A	01-01-1993
		NO 922691 A	11-01-1993
		NZ 242910 A	28-03-1995
		RO 111631 A	29-11-1996